The Mysore Coffee Experiment Station—Bulletin No. 3

DEPARTMENT OF AGRICULTURE

MYSORE STATE

REPORT OF WORK ON THE COFFEE EXPERIMENT STATION, BALEHONNUR

FOR THE YEARS

1925-30

IMPERIAL BUREAU OF MYCOLOGY
6 DEC. 1930

BY

DR. LESLIE C. COLEMAN, M.A., PH.D.
Director of Agriculture in Mysore.

BANGALORE:
PRINTED AT THE GOVERNMENT PRESS
1930

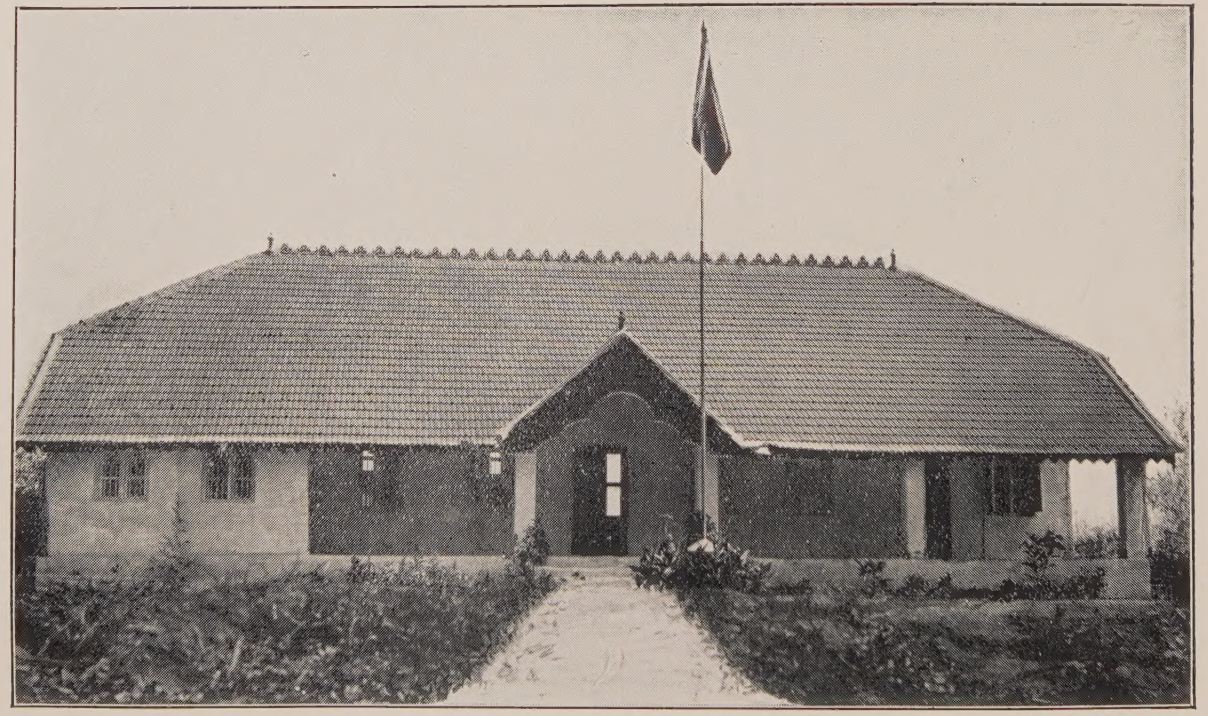

FIG. 1.

Coffee Experiment Station—Research Laboratory.

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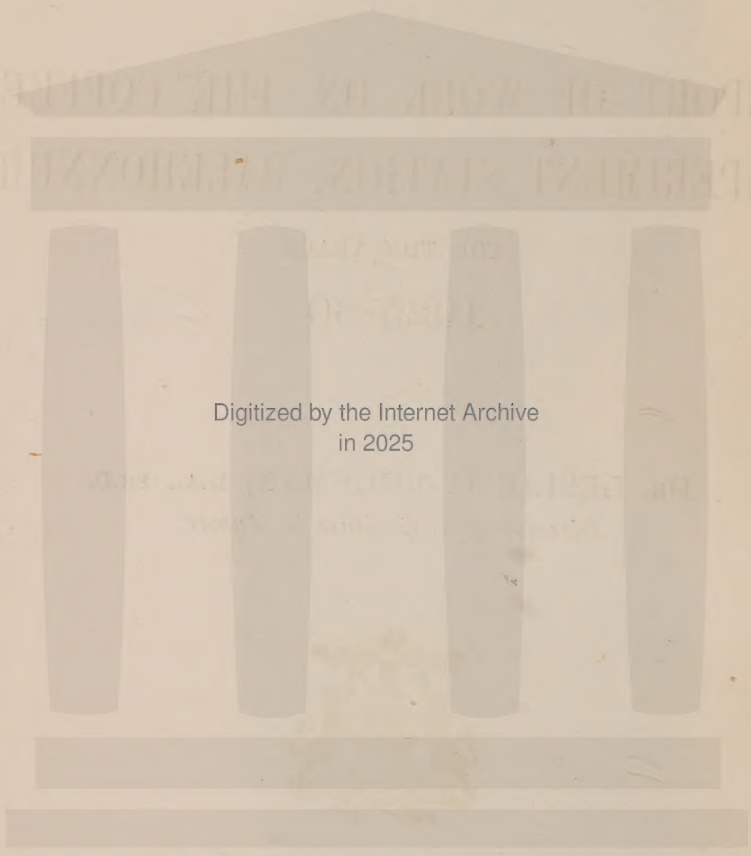

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MYSORE COFFEE EXPERIMENT STATION, BALEHONNUR.

SUPERVISION.

Dr. Leslie C. Coleman	...	Director.
Mr. E. H. Young	...	Advisory Board Members.
,, G. V. R. Frend	...	
,, T. B. Malle Gowda, M.L.C.	...	
,, A. Mahomed Hussain	...	
,, S. Pais, B.A., M.L.C.	...	

ADMINISTRATION.

Dr. M. K. Venkata Rao	...	Deputy Director.
Mr. K. H. Sreenivasan	...	Manager.
,, G. N. Kalle Gowda	...	Assistant Manager.
,, Y. R. Narayana Rao	...	Plant Breeder.
,, S. V. Narasimhachar	...	Clerk.
,, R. Vaideswaran	...	Mechanic.

CO-OPERATOR.

Mr. W. W. Mayne	...	Scientific Officer, United Planters' Association, South India.

REPORT OF WORK ON THE COFFEE EXPERIMENT STATION, BALEHONNUR, FOR THE YEARS 1925-30.

Introduction.

Work in connection with the investigation of the diseases of coffee was taken up as early as 1915 and a temporary laboratory was set up in Koppa, while field work was also carried on in the Koppa estate on a plot of land kindly placed at the disposal of the Department by Mr. H. Pilkington. The Entomological side of the investigations was carried on in the Hassan District, but there was no chance of investigating the manuring and cultivation of coffee and still less the selection of plants on scientific lines. It was deemed necessary to have an experiment station for investigating the problems of coffee on a systematic scale, an arrangement which would also give an opportunity for systematic and concentrated work in one area as opposed to the sporadic and scattered work that had been possible till then. The planters who were approached in this connection agreed to the proposal and legislative permission was sought to impose a cess of two annas per acre on every block of land classed as coffee land except where the area was fifteen acres and under. The Government agreed to contribute an amount equal to the cess revenue and the amount was to be earmarked as a separate fund for the purpose of investigating the coffee problems. The legislature finally approved of the scheme and the station was started in December 1925. For the preliminary work a sum of Rs. two thousand was given by the United Planters' Association of Southern India who also gave an additional sum of five thousand rupees the next year.

Location.

The farm is situated in the Adigebail village of the Koppa Taluk in the Kadur District and is about five miles from Balehonnur on the Koppa road. Two miles of road has been laid from the farm and the farm road joins the

main road at about 400 yards after passing the 29th mile towards Koppa. The road is accessible at all seasons of the year.

Area and Description.

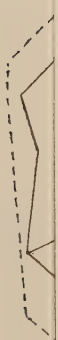
The first work on the farm was taken up on established coffee and this was rendered possible as Mr. C. S. Crawford, owner of Guntenaik and several other estates, generously offered 18 acres of growing coffee land and 18 acres of virgin jungle for a nominal lease, the farm agreeing to pay the land tax amounting to 66 rupees per year. In addition, fourteen acres of *gomal* which were under the control of Government and 165 acres of virgin forest land were included in the area of the farm. Recently the Government have sanctioned the purchase of the area already leased from Mr. Crawford, and a further 65 acres of coffee at a total cost of Rs. 20,000. The total area of the farm is therefore 280 acres (Map I.) of which 82 acres represent growing coffee 15-20 years old, 185 acres of jungle fit for growing coffee and 15 acres of land useful for grazing of cattle and buildings. The soil is of varying character and represents, about as fully as it is possible in any one locality, the different kinds of soil upon which coffee is now grown. The rainfall of the station is normally about 100 inches although within the last three years the fluctuations have been high. The following table furnishes the rainfall of the station from 1926 to date month by month:—

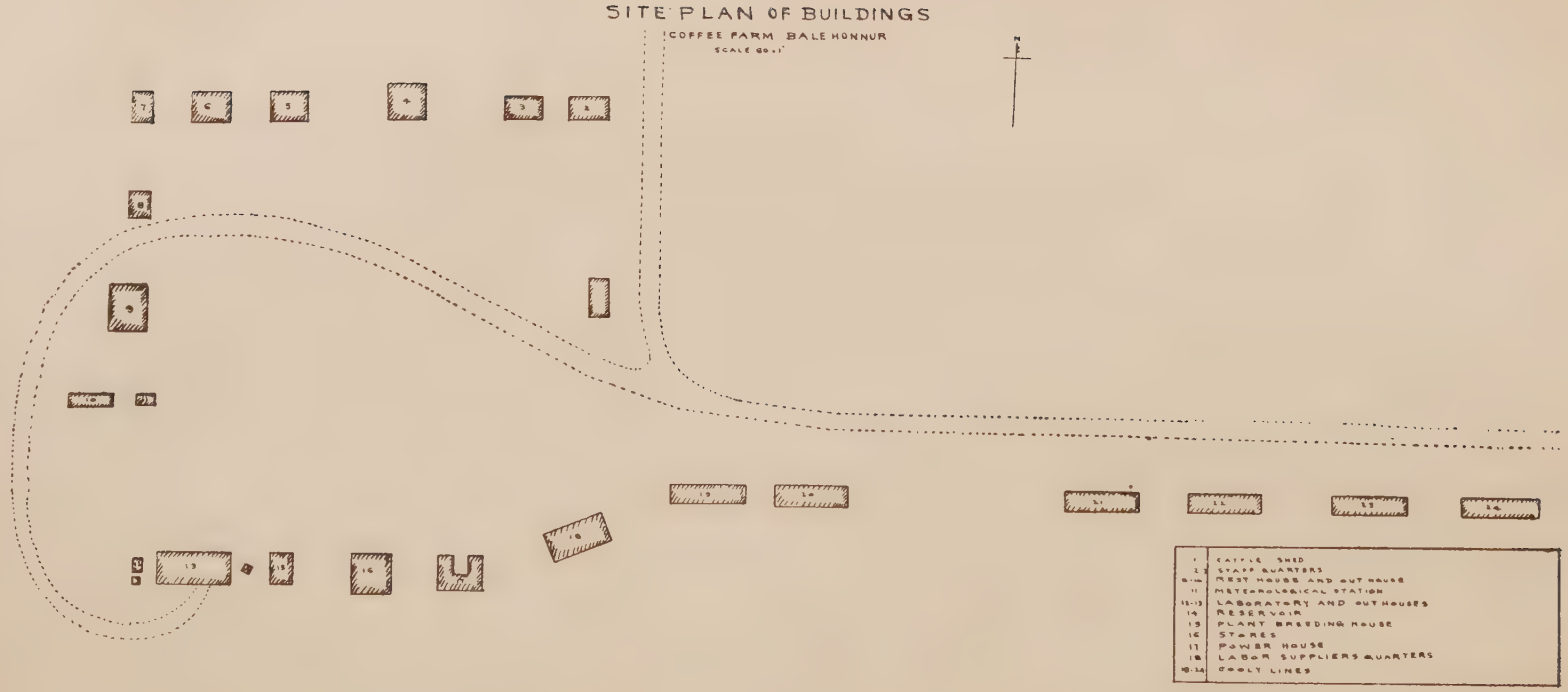
	1926	1927	1928	1929
January ...	...	...	0·10	0·27
February ...	0·27	...	2·46	...
March ...	0·19	1·55	3·12	...
April ...	0·47	2·99	2·36	10·75
May ...	2·68	7·60	1·67	5·22
June ...	6·95	13·39	16·30	20·19
July ...	33·86	52·34	22·25	34·30
August ...	34·07	17·81	25·07	17·35
September ...	6·15	8·06	1·80	9·04
October ...	3·45	0·66	12·98	4·79
November ...	...	3·11	0·59	2·14
December ...	0·03	...	1·11	...
Total ...	88·12	107·51	89·81	104·05

COFFEE

KA

SCALE 1"




SITE PLAN OF BUILDINGS
COFFEE FARM BALEHONNUR
SCALE 60 = 1'
1 CATTLE SHED
2 STAFF QUARTERS
3-4 REST HOUSE AND OUT HOUSE
11 METEOROLOGICAL STATION
12-13 LABORATORY AND OUT HOUSES
14 RESERVOIR
15 PLANT BREEDING HOUSE
16 STORES
17 POWER HOUSE
18 LABOR SUPPLIERS QUARTERS
19-24 COOLY LINES

PLAN I.

The elevation is about 2,700 feet above sea level and it is therefore slightly below the level that is usually considered most suitable for the growing of Arabica coffee. In spite of these drawbacks, the farm satisfies certain other conditions for laying out scientific experiments properly. It is obviously impossible to supply in one place all the conditions prevalent in the coffee area of Mysore where the elevations range from 2,500 to 4,500 feet above sea level and rainfall from 50 to 300 inches with soil ranging from almost grass land of the savannah type to fertile ever-green forests. The environment in which the farm is situated falls within the limits specified above.

Buildings and Accommodation. (See Plan I.).

At present there are 22 buildings as shown below :—

1. Laboratory with Gas House, (See Figure 1). Frontispiece.
2. Guest House with Indian and European Kitchen and Garage.
3. Seven Staff Quarters, (See Figure 2).
4. Four Cooly Lines, (See Figure 3).
5. Power House and Workshop.
6. Stores.
7. Propagating House.
8. Pump House.

Electric lights, gas and water are available on the farm and it is proposed to supply filtered water for the quarters and the laboratory in the near future.

Administration.

The staff consists of a Manager, Assistant Manager, a Plant Breeding Assistant, a Clerk, two Mechanics and a peon. The routine work of the farm is controlled by the Deputy Director under instructions from the Director of Agriculture. The more important phases of work are discussed and decided upon by the Director of Agriculture and the Advisory Board consisting of five gentlemen representing the planting interests in Mysore and South

India. The Board usually meets about four times a year, reviews the work done and offers fresh suggestions for work. The following list gives the names and addresses of the members constituting the advisory committee at present :—

E. H. Young, Esq., Oosoor Estate, Saklespur P. O., Representative of the United Planters' Association of Southern India.

Hajee A. Mohamed Hussain, Esq., Kardibetta Estate, Kenchammana Hoskote P. O., Representative of the Indian Planters of Hassan District.

T. B. Malle Gowda, Esq., Togarihankal Estate, Chickmagalur, Representative of the Indian Planters of Kadur District.

S. Pais, Esq., Kudaregundi Estate, Mudigere P. O., appointed by the Mysore Government.

G. V. R. Frend, Esq., Guntenaik Estate, Balehonnur P. O., Representative of the Mysore Planters' Association.

Following an arrangement come to between the Mysore Government and the United Planters' Association of Southern India, Mr. W. W. Mayne, Scientific Officer of the Association works on the Station under the direction of the Director of Agriculture, Mr. Mayne, joined duty in October 1928.

The programme of work laid out by the Director of Agriculture has been approved by the Government in their letter No. D. 9995-6—A & E. 252-27-4, dated Bangalore, 20th March 1928. It is given as an appendix (Appendix A.).

Laboratory and Library Equipment.

The laboratory is equipped with all the apparatus necessary for a study of the diseases of coffee and for work on coffee breeding, this being work that must be carried out on the spot. As the Agricultural Department has a fully equipped chemical laboratory with a fairly large staff in Bangalore, it is unnecessary at present to provide laboratory facilities for chemical work on the station. The necessary work connected with the preparation of samples will be carried out on the station and the samples

despatched to Bangalore for analysis. . The laboratory is also provided with gas, water and electricity. It is proposed later on to make special provision for Entomological work in the shape of an insectary.

The library is provided with standard reference books on plant diseases and plant breeding, and an attempt is being made to gather from all parts of the world every publication on coffee which is of any value. A special room in the laboratory building has been set apart for library and herbarium purposes.

Government have sanctioned the establishment of a Meteorological Station on the farm and the necessary equipment including wet and dry bulbs, maximum and minimum thermometers, standard barometer, anemometer, and windvane have been obtained and have been installed. In addition it is proposed to equip the station with an automatic sunshine recorder to give information on a subject which has received scanty attention in the *ghats* where the influence of the monsoon is greatest.

Experiments in Progress.

Chemical work.—The work has been continued practically on the same lines as hitherto. A brief resume is given below and the data obtained till now are given in Appendix B.

General manuring.—Testing of the effects of Nitrogen (N), Phosphoric acid (P) and Potash (K). N *plus* P, P *plus* K, N *plus* K, and N *plus* P *plus* K both in presence and absence of lime. The dosage is 25 lbs. N, 37·5 lbs. P_2O_5 and 50 lbs. K_2O.

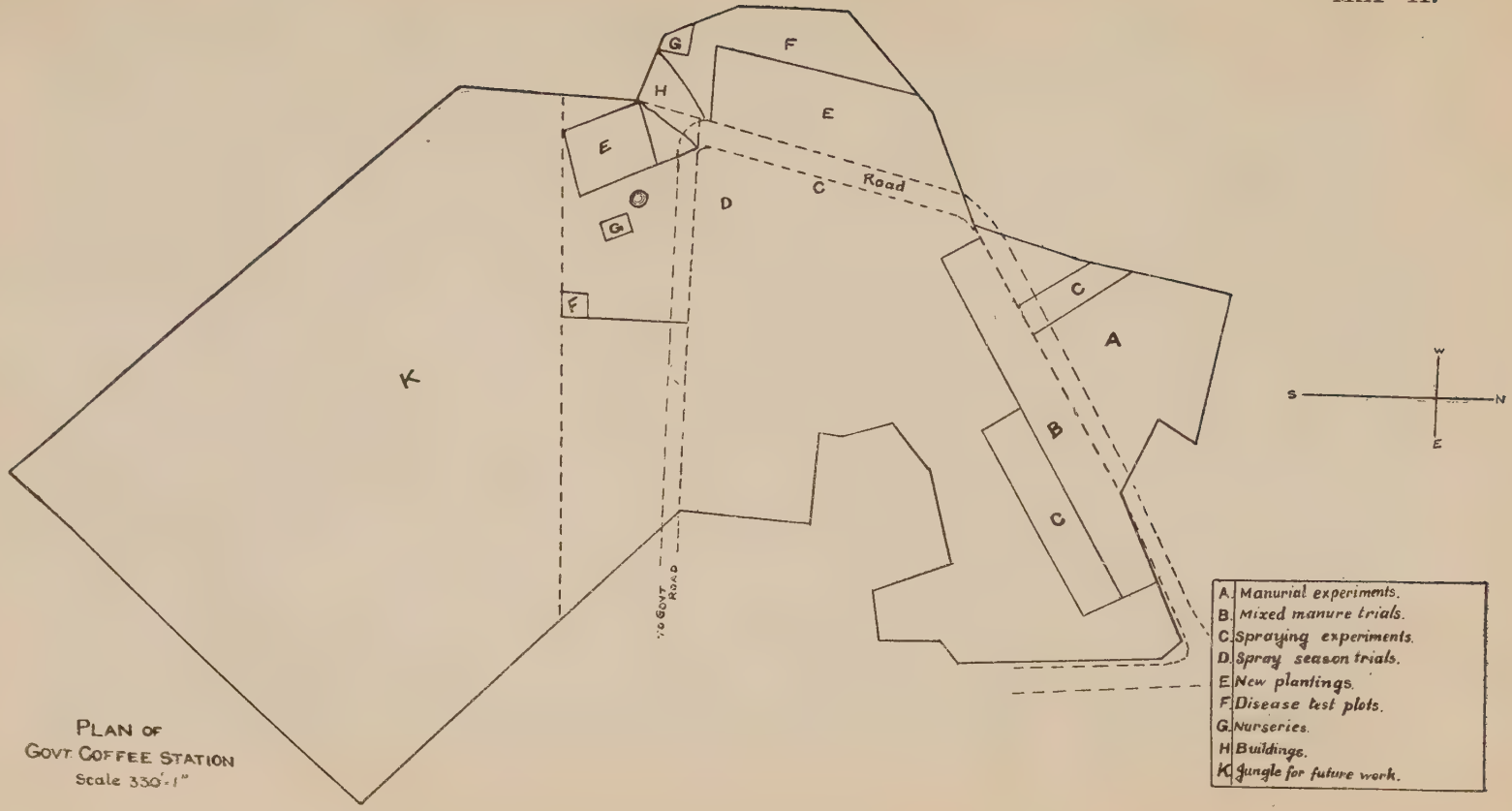
Nitrogenous manuring.—Originally this experiment consisted of testing ammonium sulphate, oil cake, floranid and green manure as sources of nitrogen for the plant, the other two plant foods being supplied uniformly for all plots. Their effect was studied both in the presence of lime and its absence. The green manure experiment has been replaced by sodium nitrate and the test is being carried on with nitrate of soda kindly supplied for experimental work through the Chilean Nitrate Committee.

Dosage experiments.—The best dose of mixture to be given for coffee is being determined by giving 25 lbs. N per acre, 37·5 N per acre and 50 lbs. N per acre, the other two ingredients being proportionately increased to maintain the ratio of 2:3:4 of N, P, K.

Phosphate Experiments.—Similar to the nitrogen series, superphosphate, basic slag, steamed bone and raw bone are being tested as sources of phosphoric acid supply for the plants, the remaining two plant foods being the same. Its effect in the presence and absence of lime is also being investigated.

Potash series.—The same type of experiment has been carried on to decide the relative merits of potassium sulphate and potassium chloride as sources of potash both in the presence and absence of lime. Map II shows the location of the manurial and other experiments. With the acquisition of the extra area of coffee, manurial experiments are being greatly expanded with the object of obtaining the most accurate information possible on the manuring of coffee.

MAP II.



PLAN OF
GOVT. COFFEE STATION
Scale 330'-1"

Mycological.

Importation and testing of new types of sprayers.—During the year, in addition to the one gallon pressure sprayers which were hitherto used for work, three different types of sprayers were imported and are being tested for comparative efficacy and cost.

The Drake and Fletcher Headland Sprayer worked by three men at the pump, four for the hose and one for agitating and supply of the mixture, at a nominal pressure of 200 lbs. per square inch and an effective pressure ranging from 150—200 lbs. can spray one to one and a half acres per day. This sprayer is shown in Figure 4.

The Holder Battery Sprayers six, each of 22 litre capacity, worked by a gang of eight men, six to carry sprayers, one to pump and one to supply the mixture can cope with spraying approximately the same area. The spray is finer but the weight of the sprayer with the liquid is about 30 lbs. and very few people among the coffee estate labourers can carry this weight on their back and carry on spraying for any length of time. A smaller container will be most likely an efficient substitute. These sprayers are shown in Figures 5 and 6. One of them is being charged.

Motor Sprayer.—This is a power sprayer manufactured by Holder with four lines of hose (the original machine carried only two and the four hose arrangement has been specially designed for the Department) and can handle about three acres per day with a gang of six men four for the hoses, one for supplying spray mixture and one for attending to the engine. The petrol consumption is about two gallons per day to which has to be added one bottle of mobil oil. The cost is likely to work out slightly higher than in the case of the Headland Sprayer but the spraying is very even. For large estates machines of this type seem to hold out considerable promise. This sprayer is shown in Figure 7.

2. *Testing of Alum Bordeaux with ordinary Bordeaux mixture and fungicidal dust* has been undertaken on the farm and the effects are being watched. Although no quantitative data are yet available, the indications are that the alum Bordeaux is just as effective as ordinary Bordeaux in the control of Black Rot and Leaf Disease of Coffee. The powder dust is distinctly inferior as a means of control.

3. *Dusts imported* from America, Kolo dust, Bordeaux dust and Oxidised sulphur and one dust, Verminite from England, have been tried as a means of controlling

fungus diseases. Even with the very best efforts, it has been found that none of them has been effective mainly because it will not stick to the under surface of the leaf. A new dust put up by a Bombay firm which had copper sulphate, lime with large percentage of magnesia and casein ground into a fine powder was apparently enquired after by a few planters and as the laboratory tests of this dust are unsatisfactory, a note was published in the Planters' Chronicle by the Director warning the planters against the purchase of this material. Another firm in Bombay has attempted to put on the market a patent preparation apparently containing raw sulphur ground into a fairly fine powder and screened through a mesh, as a fungicide. It has not the same fineness as the Kolo dust and stands still less chance of adhering to the leaves.

4. *Testing of ordinary and half strength Bordeaux.*—To test the relative efficiency of a weaker strength of solution, an area was marked and sprayed with a 5-5-100 (weak) solution as opposed to a 5-5-50 solution in November last. Half of it has been resprayed with similar strength of solution to watch the effects of one spraying as compared with two sprayings of ordinary weak solutions.

5. *Testing of the effect of various adhesives with Bordeaux.*—This work is being carried out with a number of adhesives to ascertain which is the most efficient in holding the spray on the leaves. While the results of experiments with different sprayers and sprays are not yet complete, information of great practical importance has already been obtained. As the area of coffee sprayed is increasing rapidly and as the interest in the subject has spread to all classes of planters, it has become necessary to publish at once the results of our investigations so far. This is being done.

6. *Moss control work.*—Repeated enquiries have been received in regard to a method for controlling moss on coffee stems as it is believed by some planters that moss growth is deleterious to the growth of coffee plants. Trials have been made with sulphuric acid, copper sulphate, iron sulphate and lime either singly or in combination and the results till now indicate the possibility of controlling this epiphyte by the use of iron sulphate either singly or in combination with copper sulphate. The progress of the development of moss on these stems will be watched during the present monsoon.

7. *Blackrot Investigation.*—For taking up a study of the causes which are responsible for the outbreak of

the black rot, plants which had a very heavy disease have been marked and are being watched to find out if these will serve as centres of infection during the coming season. Infected leaves collected two years ago were placed in boxes protected with rabbit netting and allowed to remain in the estate under as natural conditions as possible. Some of these old infected leaves were then attached to healthy leaves on coffee plants during the last monsoon. The disease spread on to the healthy leaves from the old diseased ones. This definitely establishes the fact that the disease is carried over through the dry season on the old diseased leaves.

8. *Work of the Scientific Officer, United Planters' Association of South India.*—As stated above, Mr. Mayne joined duty in October 1928. After a preliminary tour in the main coffee areas of Mysore and Coorg to enable him to become familiar with the problems awaiting investigation, Mr. Mayne took up the study of certain important diseases of coffee. His attention has, up to the present, been devoted mainly to leaf disease, 'die back' and the various root diseases of coffee. Two isolated blocks of five acres each, in two different soil areas, have been set apart for Mr. Mayne's use. On these he will be able to study the progress of the various diseases in the field and will at the same time be able to carry out infection experiments under field conditions. He will further be able to co-operate with the plant breeding section of the station in studying the resistance of the various selections of coffee developed or tested on the station to the important diseases which attack coffee in South India. This co-operative study is certain to lead to valuable results.

Entomological work.—The attention of the Entomological Section is being devoted, at present, mainly to the study of coffee borer. This work has to be carried out in areas and on estates where borer is particularly prevalent. As field investigations have been in progress in a number of these estates for several years it would be inadvisable to discontinue this work now even were conditions as regards borer infestation favourable for study at the station. As a matter of fact, there is very little borer attack on the station and it would seem to be unwise to change conditions by the cutting out of shade so as to favour an increase of borer, more especially as that would undoubtedly interfere with the other experimental work being carried on.

One problem that is being taken up at the station is the possibility of preparing a combined spray to control at the same time leaf disease and green bug. There is some evidence that where spraying with Bordeaux for the control of leaf disease is practised green bug increases. It is too early to say whether this will prove a serious obstacle to the introduction of spraying with Bordeaux, but it is certainly necessary to be prepared for such a contingency. Work has been taken up on the station in this connection in collaboration with the Entomological Section of the Department but no definite results have as yet been obtained.

Plant Breeding work.—The work has consisted of experiments given below and no results can be reported for a considerable time to come as coffee does not come to full bearing until about five years old and then the accumulation of data will take some more time after that.

(*a*) Improvement by selection in Arabica coffee for high yield.

Improvement by selection in Robusta coffee for high yield.

Improvement by selection in Hybrid coffee for high yield.

(*b*) Grafting of Arabica suckers on Robusta and Liberian coffee by cleft and double cleft methods and approach grafting on Robusta and Arabica seedlings. The grafts have been successful and a number of them have been planted out in the field to test their performance. There are about 300 grafts in the nursery and they will be planted out in the field this season. Investigations as to the best method and most satisfactory time for grafting have been carried out and are being continued. Figures 8 and 9.

(*c*) Growing of hybrids of Liberica-Arabica and Robusta-Arabica and studying their progeny. Work has also been done with regard to selfing selected coffee plants and artificially pollinating Robusta, Arabica, Kent and Netrakonda. The seed will be used for further breeding work.

(*d*) Testing of varieties of coffee for yield and disease resistance notably such varieties as Maragogype, Canephora, Golden drop, Uganda, Quillou and Excelsa.

(*e*) Selecting for resistance to root rot by collecting seed from plants surviving in heavily infected areas.

Other crops.—A plot has been laid out for testing the suitability of different green manure crops, notably Boga-

medaloa, *Leucaena glauca*, *Crotolaria striata*, *Cassia hirsuta* and *Cassia tora*. Seeds of other green manure plants have been imported from Ceylon to extend this work in the coming season.

Results of work on the Chemical side up-to-date are tabulated in Appendix B. Further work will be necessary before any conclusion can be drawn. The nature of the Mycological and Entomological problems is such that some time must elapse before definite results can be obtained. On the plant breeding side extensive selections have been made and this work will be continued vigorously in the next few years. A list of plants now growing is furnished in Appendix C.

Programme of work for the next year:—

(1) Continuing the work on the lines already laid down by the Director and approved by the Government.

(2) Extending experiments on the control of moss from the point of view of farm economics.

(3) Developing the 65 acres of coffee land newly bought by means of spraying and cultivation.

(4) Laying out new experiments on testing of additional manures such as Ammophos, Monammonphos, Parry's mixture, etc., in consultation with the Chemical Section.

(5) Taking up plant breeding work on cardamoms by importation of seedlings from the cardamom estates in South India and the Bombay Presidency and by selection in the areas in the State.

(6) Laying out plots for testing disease resistance by infecting the soil and planting the seedlings from the plant breeding section in this area to test their relative resistance.

(7) Artificial hybridisation of Kent, Arabica and Robusta varieties and studying their progeny.

(8) Laying out manurial experiments for studying the effect of manures on young coffee plants (from one year old up to the time of coming to bearing).

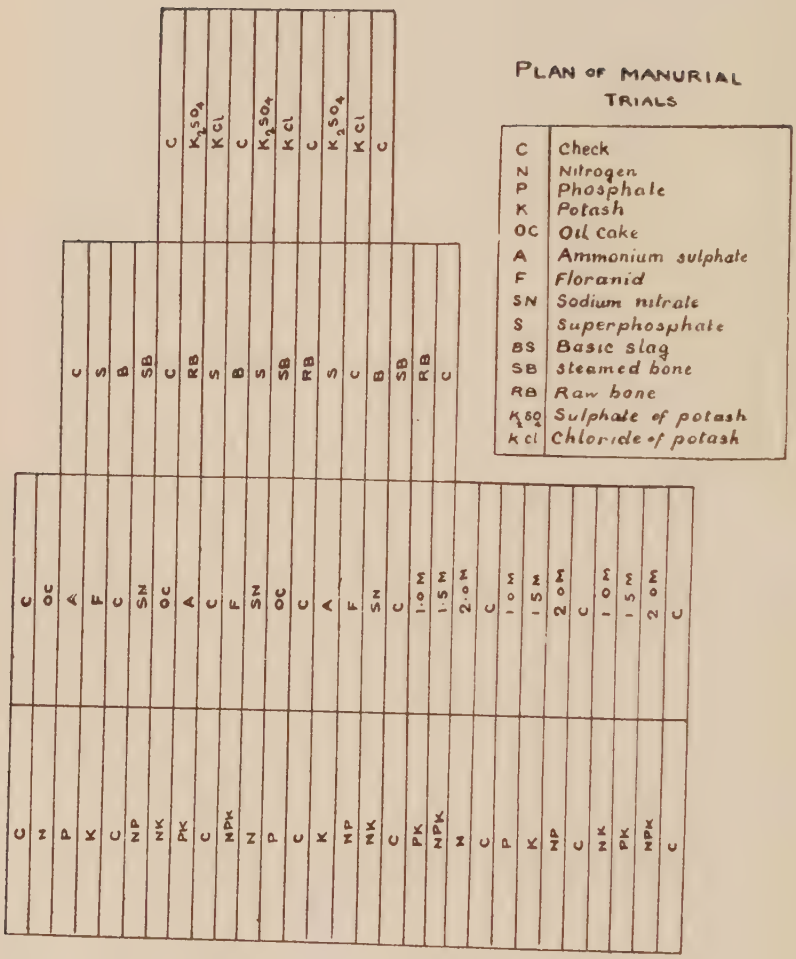
(9) Laying out cement cisterns for studying the effect of lime on coffee and taking up work on Hydrogen ion concentration.

(10) Continuing to give advice for control of diseases of coffee and visiting estates as far as possible for selection work.

While the programme laid above is only for the next year and tentative, additional work is being done both by

the Entomologist and the Chemist in other coffee growing areas of Mysore. Mr. Mayne, the Scientific Officer of the United Planters' Association of South India, who has excellent opportunities for visiting other coffee areas outside Mysore will, in the course of his work, tackle problems which are not mentioned above. In addition the staff of the station is always willing to take up any other problems that may be brought to its attention by the planters and investigate them as far as time and facilities permit. The study of the weed flora of the estates will be taken up as far as possible to correlate characteristic vegetation with the soil types in coffee areas.

PLAN II.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PLAN OF MANURIAL TRIALS
C Check
N Nitrogen
P Phosphate
K Potash
OC Oil cake
A Ammonium sulphate
F Floranid
SN Sodium nitrate
S Superphosphate
BS Basic slag
SB Steamed bone
RB Raw bone
K2SO4 Sulphate of potash
KCl Chloride of potash

APPENDIX A.

Programme of work for the Coffee Experiment Station, Balehonnur.*

Main Projects.

The main projects on the farm may be outlined under the following heads :—

(*a*) *Chemical.*—A study of the manurial requirements of coffee.

(*b*) *Botanical.*—An attempt to improve coffee in vigour, quality and disease resistance through selection and hybridization.

(*c*) *Mycological.*—A study of the diseases of coffee the chief of which are leaf disease, black rot, die back and root rot with the object of bringing them under control.

(*d*) *Entomological.*—A study of the insect pests of coffee the chief of which are green bug and coffee borer.

(*a*) *Chemical.*—For the purpose of carrying on manurial experiments it is necessary to use coffee of as uniform a character as possible. The growing area handed over by Mr. Crawford fulfills this requirement to as great a degree as almost any area I have seen. Of this area, only the most uniform inner portion has been laid out in plots for the testing of different manurial treatments as illustrated in the enclosed plan (Plan II). The balance of the area not being very suitable for manurial experiments will be used for experiments on leaf disease and die back, the two diseases which are to a certain extent prevalent on this particular piece.

This manurial area should be reserved for the purpose for at least ten years by which time we may have another area planted up and brought to maturity which can be used for the purpose.

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* This programme was prepared and approved by Government in 1928 at which time we had only 17 acres of mature coffee. The recent addition of 65 acres has enabled us to embark on a much more extensive scheme of experiments and spraying than was then possible.

(*b*) *Botanical.*—The work on breeding for vigour, quality and disease resistance should form the main work of the farm and should on no account be jeopardised by or sacrificed to anything else. Breeding of a perennial crop such as coffee will require time. I estimate at least ten years will be required to give the first practical results and it will probably require twice that period to give results of the greatest value. This necessitates that the plan of operations must be most carefully considered beforehand and once fixed must be adhered to rigidly and carried out with the greatest perseverance. A changing policy would jeopardise the work and lead to deplorable waste of time and money.

Breeding work will involve the growth of many thousands of individual plants under as nearly uniform conditions as possible. This work will necessitate close and continuous observation on the part of the staff. The breeding plots should, therefore, be large and as near to the buildings as the requirements of soil will permit. I propose to reserve ten acres of the best part of Mr. Crawford's jungle and 15 acres of the Government jungle for this purpose. These areas are about a hundred yards from the laboratory site.

In addition to the 25 acres reserved for breeding work, an area of about 100 acres should be reserved for the multiplication of our improved varieties and the production of seed for distribution. To prevent cross fertilization of these varieties it will be necessary to have the multiplication plots surrounded by belts of jungle. These multiplication plots will not come into use probably for ten years as it will take that long to develop our first selections to the point where we are able to multiply them.

In addition to this definite breeding work, investigation of the possibility of growing high quality Arabica coffee on vigorous root stocks such as Robusta by grafting should be taken up immediately. This will demand the remainder of the area in Mr. Crawford's jungle, roughly 7 acres.

(*c*) *Mycological Investigations.*—As already noted, the main diseases at present to be found on coffee in South India are leaf disease, black rot, die back and root or stump rot. The investigation of these diseases can be undertaken partly on the area of growing coffee handed over by Mr. Crawford. However, black rot and stump rot are not serious on the plot nor are they likely to be in the near future. Arrangements will be made immediately with

planters in the neighbourhood and farther afield for the provision of facilities for field study. Mr. Crawford's large holdings in the neighbourhood should furnish us with all the materials we require for the purpose within a radius of a few miles. The chief additional requirements in this connection are laboratory facilities for investigation on the spot and these will be provided as fully as possible.

In addition to the above we have the investigation of the value of various fungicides and of the efficiency of the various types of spray machinery. I have already had assurances from Mr. Frend, Mr. Crawford's manager, that he will provide us with facilities in this regard.

I may note that practical results are likely to accrue from this type of work much sooner than from our breeding work but the final results from it are not likely to be so important.

(*d*) *Entomological.*—As in the case of Mycological work, facilities for field work on the insect pests of coffee will have to be sought largely on private estates in the coffee area. The station will furnish us with the essential laboratory and insectary facilities and will serve as a centre for the work.

Other Coffee Problems.—There are of course a large number of problems connected with coffee cultivation which are not covered by the above programme. Among these may be mentioned problems of cultivation and shade. These problems are, I consider, not of such pressing importance as to warrant our locking up comparatively large blocks of land for the purpose and so interfering with the more important breeding work which should remain the main object of the station's activities. There is always danger of taking up more problems than the staff of the station can handle and our facilities will warrant. We must guard most carefully against this danger.

Subsidiary Lines of Work.—While the station should remain primarily one for the investigation of coffee problems, I believe it should be utilized for the study of other planters' crops as well. Among these may be mentioned cardamoms, pepper, and tea, all crops either of present or potential importance to the State. The natural facilities for the study of cardamom cultivation and varieties are, I consider, particularly good and, as this important crop has heretofore received practically no scientific attention, we have a large and useful field before us. I propose starting on a study of cardamom varieties with the object of

obtaining materials for breeding work. A study of cardamom pests and diseases as also cardamom manuring will be taken up as occasion permits. Somewhat similar work will be undertaken on pepper, while in connection with tea, the only problem I should propose taking up in the near future is a study of root rot, a disease either closely related to or identical with the root rots of coffee. I may point out that starting work on these will not involve the utilization of any land at all suitable for coffee experiments.

An examination of this memorandum will show that it will be necessary to reserve about 150 acres for experimental work which will be brought into cultivation in from 15 to 20 years. In the next few years an annual planting of from 5 to 10 acres is all we should undertake as we must reserve our jungle for the planting of our selected varieties. This indicates clearly that we must not look to direct revenue from the station as a very important factor in financing the station's activities. It would, I consider, be a most serious breach of trust if we were to attempt to make the station even to a moderate degree self-supporting by sacrificing the real functions of the station to the clamour for revenue. The planting up of large areas of jungle now would simply make it impossible to carry on the real programme of the farm, for when we came to the stage when we wanted to multiply our selections we should either have no land on which to grow them or would have to uproot coffee of say 10 or 15 years standing. Even then the land would probably be very seriously reduced in value from a coffee growing standpoint.

The following is the summary of the important points in this memorandum :—

1. This station must be used as an experiment station and not for the purpose of attempting to grow a large acreage of coffee at a profit.

2. Coffee breeding should be the chief item of the work on the station and about 125 acres should be set apart for the actual breeding work and the multiplication of seed from selected varieties once they are secured. It is unlikely the whole of this land will be brought under cultivation within a period of less than 20 years.

3. Work on the manurial requirements of coffee has already commenced and should form the main item of work on the area of coffee handed over by Mr. Crawford probably for the next ten years. As areas are planted up

to our selections, these will become available for further manurial experiments and for such other experiments as those on cultivation, influence of shade, etc.

4. The work on the diseases of coffee will be centred in the station. Field work in this connection will be carried on as far as possible in the station, but will have to be extended to estates and areas where the particular diseases are most prevalent. This applies especially to the study of control measures.

5. Work on the insect pests of coffee will have to be conducted in much the same manner as that on diseases.

6. In addition to the investigation of coffee problems, those concerning other planters' crops such as cardamom, pepper and tea should be taken up on the station only when the staff and funds permit. They should in no way be allowed to interfere with the real functions of the station as one for the study of coffee problems.

LESLIE C. COLEMAN,
Director of Agriculture.

APPENDIX. B.

The following statement gives the yield for various treatments for 5 years since 1925.*

Yield of Berries in lbs. per acre.

	1925–26	1926—27	1927—28	1928—29	1929—30
Bulk ...	159	932	396	335	...
II. General manurial requirements.					
Check ...	435	2,313	584	706	1,718
Groundnut cake (N).	413	2,256	547	809	1,927
Super (P) ...	536	2,530	610	950	1,818
Potash (K) ...	436	2,327	850	748	1,740
N. P. ...	557	2,518	684	814	2,067
N. K. ...	557	2,336	591	673	2,028
P. K. ..	416	2,396	499	607	1,683
N. P. K. ...	509	2,854	607	970	1,691
III. Various Nitrogenous manures.					
Check ...	398	2,068	601	835	1,155
G. nut cake ...	418	2,138	476	1,071	1,193
Am_2SO_4 ...	341	2,484	782	914	1,470
Floranid ...	410	2,250	776	888	1,196
Nitrate of Soda ...	...	...	...	823	1,200
IIIa. Varying doses of complete manure.					
Check ...	264	1,449	398	691	1,022
Complete Manure Single dose.	252	2,361	441	833	1,187
Complete manure 1·5 doses.	381	2,190	449	920	1,217
Complete manure 2 doses.	336	1,884	380	726	1,180
IV. Various phosphatic manures.					
Check ...	297	1,484	754	517	1,293
Super ...	365	1,764	976	618	1,708
Basic slag ...	288	1,702	720	600	1,587
Steamed bone ...	277	1,309	620	668	1,283
Raw bone ...	241	1,350	697	615	1,188
IV. Various Potash manures.					
Check ...	214	1,174	905	420	1,489
K_2SO_4 ...	186	1,271	881	552	1,639
KCl ...	221	1,455	943	560	1,750

*The differential treatment was started in September 1925. Its effect on yields is seen only partially in 1926-27 and more completely from 1927-28 onwards.

APPENDIX C.

Statement showing the selected strains on the Station and the year of planting, etc.

Number allotted on the Station	Variety	Name of Estate
10	Coorg 1926 planting ...	Subbankudige
13	Do do	Igoor
14	Talagony selection 1926 planting ...	Kumergod
15	Coorg do ...	Baskul
16	Kent do ...	do
17	Coorg selection do ...	Chandrapore
18	Chandrapur Hybrid do ...	do
20	Blue Mountain do ...	Sampige
21	Coorg do ...	do
31	Bunch bearing do ..	Biccode
54	Hybrid 1927 planting ...	Subbankudige
55	Old Coorg Coffee 1927 planting ..	do
56	Nethrakonda do ..	Nethrakonda
57	Parent of Kent do ...	Wager
58	Hybrid do ...	Kumergod
59	Golden Drop do ..	Merthikan
60	Hybrid do ...	Arthavalli
64	Yellikodige special 1928 planting ...	Harley
65	Old Coorg prolific bearer do ...	Kesluvurthy
66	Robusta Arabica Hybrid do ...	do
67	Coorg Type do ...	do
69	Bettadamalale Hybrid do ...	Thogari Handloo
71	Special Kent do ...	do
75	Cross work like Arabica liberica, 1928 planting.	Ubban
78	Hybrid 1928 planting ...	Dubla
85	Coorg Type do ...	Bykaravalli
	SEEDLINGS IN THE NURSERY TO BE PLANTED DURING THIS SEASON.	
86	Hybrid No. I ...	Attikan
87	do No. II ..	do
88	do No. III ...	do
89	do No. IV ...	do
90	do No. V ..	do
91	Hybrid No. I ...	Heggoodloo
92	do No. II ...	...
93	do No. III ...	...

APPENDIX C—*contd.*

Number allotted on the Station	Variety	Name of Estate
94	Selection ...	Bangalore
95	Hybrid (29) ...	Chandrapore
96	do (38) ...	do
97	do (39) ...	do
98	do (42) ...	do
99	do (49) ..	do
100	do (50). ...	do
101	No. 5 ...	Kumergod
102	do ...	do
103	Nalakanad "A" ...	do
104	do "B" ...	do
105	Arbid khol kent type ...	do
106	No. 4 ...	Dubla
107	No. 9 ...	do
108	No. 11 ...	do
109	No. 14 ...	do
110	No. 23 ...	do
111	No. 27 ..	do
112	No. 30 ...	do
113	Golden Drop ...	do
114	Robusta ...	Guttikan
115	No. 2 Interior Hybrid ..	Betkodi
116	No. 1 Road Side Hybrid ...	do
117	Robusta Arabica Hybrid ..	Bettadamane
118	Cross between Mockett's and Kent ..	Warthyally
119	Hybrid No. 2 ...	Holalu
120	do 4 ...	do
121	do 8 ..	do
122	do 10 ...	do
123	do 11 ...	do
124	do 13 ...	do
125	do ... 17 ..	do
126	do 20 ...	do
127	do 22 ...	do
128	do 25 ...	do
129	do 26 ...	do
130	do 28 ..	do
131	do ... 31 ...	do
132	do 33 ...	do
133	do ... 41 ...	do
134	do ... 42 ...	do
135	do .. 44 ...	do
136	do ... 49 ...	do
137	do .. 68 ...	do
138	do ... 70 ..	do

APPENDIX C—*contd.*

Number allotted on the Station	Variety	Name of Estate
139	Hybrid No. 91	Holalu
140	do 94	do
141	do 129	do
142	do 131	do
143	do 148	do
144	do 167	do
145	do 170	do
146	do 184	do
147	do 188	do
148	do 200	do
149	do 229	do
150	do 260	do
151	do 385	do
152	do 395	do
153	do 398	do
154	Thunde Kan Hybrid 12	Santaveri
155	do 13	do
156	do 14	do
157	do 16	do
158	Hosakan Hybrid 19	do
159	do 20	do
160	do 23	do
161	do 28	do
162	do 32	do
163	do 42	do
164	do 50	do
165	Kesinvurthy Hybrid No. 30	Kesinvurthy
166	Beetay Kan Hybrid No. 1	Santaveri
167	do do 8	do
168	do do 4	do
169	Take Hybrid No. 10	do
170	Hybrid No. 34	Mavinkere
171	do 83	Channahadlu
172	do 88	do
173	do 101	do
174	do 106	do
175	do 149	do
176	do 157	do
177	do 159	do
178	Someswara Kan Hybrid	do
179	Arabica selection—Mallarasangudda	do
180	Hybrid No. 2	Hirehasodi
181	do 4	do
182	do 6	do
183	do 7	do

APPENDIX C—*contd.*

Number allotted on the Station	Variety	Name of Estate
184	Hybrid No. 9 ...	Hirehasodi
185	do 10 ...	do
186	do 15 ...	do
187	do 21 ...	do
188	do 22 ...	Kogode
189	do 29 ...	do
190	do 31 ...	do
191	do 34 ...	do
192	do 35 ...	Kanador
193	do 36 ...	Kogode
194	do 37 ...	do
195	do 38 ...	Kanador
196	do 39 ...	do
197	Kartikere Hybrid No. I ...	Kartikere
198	do do II ...	do
199	do do III ...	do
200	Honnemetti selection ...	Honnemetti
201	Robusta ...	Kerehuckloo
202	Hybrid ..	Sripathi Kan
203	Hybrid, Bettadamane ...	Bettadamane
204	Arabica I ...	Mattasagar
205	do II ...	do
206	do III ...	do
207	Orange yellow, Hybrid ...	Kogode
208	Drooping Hybrid ..	Hirehasodi
209	Jackson Hybrid 4 year old plant ...	do
210	Marigogypi Type I ..	Cowcoody
211	do II ...	do
212	do No. I Hybrid. Free bearing.	do
213	do Hybrid II generation Type I.	do
214	do do Type II.	do
215	Dodluckunda II generation II plant Liberia x Coorg.	do
216	Basavanahalli *via* Igoor ...	do
217	Golden drop ..	do
218	Newcome Hybrid ...	do
219	Bettagere Hybrid ...	Bettagere
220	M. 7 ...	Selections by the Scientific Officer, U.P.A.S.I.
221	M. 8 ...	
222	M. 9 ...	
223	M. 10 ...	
224	M. 12 ...	
225	M. 13 ...	

APPENDIX C—*concld.*

Number allotted on the Station	Variety	Name of Estate
226	M. 14 ...	Selections by the Scientific Officer, U.P.A.S.I.
227	M. 16 ..	
228	M. 17 ...	
229	M. 18 ...	
230	M. 19 ..	
231	M. 20 ...	
232	M. 21 ...	
233	M. 22 ...	
234	M. 23 ...	
235	M. 5 ..	
236	M. 6 ..	
237	M. 24 ...	
238	Blue mountain Jamaica ..	Balur
239	Old Chik ...	do
240	Robusta ...	Peradeniya, Ceylon
241	Quillon ...	do
242	Uganda ..	do
243	Hybrid ...	do
244	Canephora ...	do
245	Liberica pasir pogor ...	do
246	Excelsa ..	do

WD 3165—GPB—1,000—30-7-30

FIG. 2.

View of the Staff Quarters.

FIG. 3.

General View of some of the Cooli Lines.

FIG. 4.

Drake and Piatson Knapsack Sprayer in action.

FIG. 5.

Charging a Battery Sprayer (Holder Six No. 1) with the mixture contained in the barrel.

FIG. 6.

Spraying with a Battery Sprayer.

FIG. 7.

Motor Sprayer (Holder), with four long hose attachment.

FIG. 8.

Grafting of Young Coffee Plants in the Nursery. Inverted glass tubes protect grafts from drying.

FIG. 9.

Grafted Coffee Plants four months old.

FIG. 10.

General View of a portion of a Coffee Estate thoroughly sprayed.

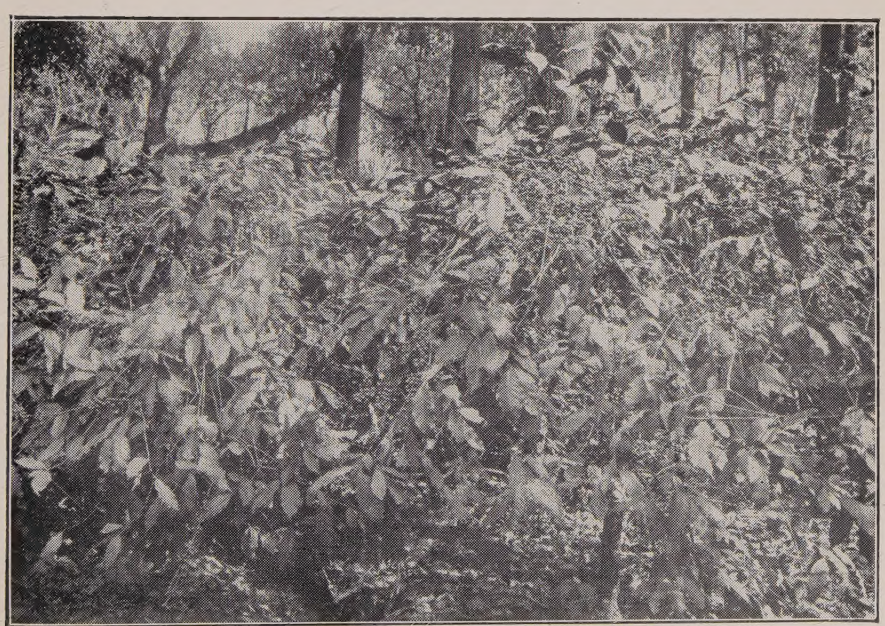

FIG. 11.

Close View of Sprayed Coffee Bushes. Note the heavy crop and the large number of leaves retained.